

BRUSH ASSEMBLY

FIELD OF THE INVENTION

The present invention relates to electric motors and more particularly to
5 brushes and brush assemblies implemented therein.

BACKGROUND OF THE INVENTION

Electric motors are used in a variety of applications, including power tools. Such electric motors generally include a motor shaft, a motor armature, 10 a field pole, field windings, a commutator assembly, brush holders and electrical leads. The electrical leads selectively link brushes to a power source. The motor armature is fixed for rotation with the motor shaft and a series of copper conducting wires are wound in various patterns about peripheral slits. Ends of the wires are fused to the commutator. The 15 commutator is fixed for rotation with the motor shaft and provides an electrical connection between the rotating armature and the stationary brushes. The brush holders each slidably support a carbon brush that is in sliding contact with the commutator. Generally, the stationary brushes are held in contact with an outside surface of the commutator by spring tension and complete the 20 electrical circuit between the rotating commutator and a power source.

Various spring biased mounting configurations have been developed to maintain brush contact with the commutator. Effectiveness and wear durability of the brush is decreased when the brush is subjected to arcing. Arcing generally occurs as a result of the brush bouncing away from the 25 commutator as rough spots and irregularities of the commutator pass under the brush. Prior art brushes include recesses formed therein for retaining an end of a biasing spring for effectively biasing the brush in contact with the commutator. These prior art recesses, however, tend to be overly complex and thus more difficult to manufacture. Further, prior art recesses fail to 30 prohibit lateral movement of the biasing spring.

Therefore, it is desirable in the industry to provide an improved brush having a simplified recess. The recess should concurrently provide sufficient

biasing of the brush in contact with the commutator to avoid arcing and other detrimental occurrences.

SUMMARY OF THE INVENTION

5 A brush assembly is provided for implementation in an electric motor. The brush assembly includes a base with a member to secure the base to a motor. A brush housing is associated with the base and has first and second open ends. A brush, defining an axis, is slidably supported within the housing between said first and second open ends. The brush extends from one of the
10 first and second open ends. The brush includes a surface having a spring retention plunge. The spring retention plunge has an arcuate face angled relative to the axis. The brush assembly further includes a biasing member exerting a force directly on the arcuate face to bias the brush within the housing to contact with a commutator. An electrical connector is electrically
15 coupled with the brush to electrically connect between the commutator and a power supply.

Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while
20 indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

25 The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

Figure 1 is a perspective view of a motor including a brush assembly in accordance with the present invention;

Figure 2 is a perspective view of the brush assembly;

30 Figure 3 is an exploded view of the brush assembly;

Figure 4 is a plan view of the brush assembly in non-worn condition relative to a commutator shown in phantom;

Figure 5 is a plan view of the brush assembly in a worn condition relative to the commutator;

Figure 6 is a perspective view of a brush of the brush assembly; and

Figure 7 is a perspective view of a power tool implementing the motor 5 of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description of the preferred embodiment is merely exemplary in nature and is in no way intended to limit the invention, its 10 application, or uses.

With particular reference to Figure 1, a motor 10 is provided and includes a frame 12, windings (not shown), a commutator 14, a brush assembly 16 and a end cap 18. The brush assembly 16 is shown to couple with the end cap 18 and includes a base 20, a housing 22, a spring 24, a 15 brush 26 and an electrical connection 28. The base 20 is preferably formed of a non-metallic or non-electrically conductive material and has a pair of arms 30 to secure the brush assembly 16 to the end cap 18. Further, the base 20 includes a web 32 which connects the two arms 30. The web 32 has a recess 34 which receives the housing 22. The housing 22 is secured in the recess 20 34 by tabs 36 which are bent under the base 20.

The housing 22 includes an open, tubular member 40 with a rectangular cross-section. The tubular member 40 has first and second open ends 42, 44. The first open end 42 is positioned adjacent to the commutator 14 when the brush assembly 16 is assembled onto the motor 10. First and 25 second slots 46, 48 are positioned on respective sides of the tubular member 40 and extend from the second open end 44. The slots 46, 48, respectively, enable the spring 24 and electrical connector 28 to move with the brush 26. Also, a unitary shunt connection and connector 50 are formed with the housing 22. The connector 50 enables an electrical contact 52 to be coupled 30 with the housing 22. The shunt connection 50 has a cutout 54 which interacts with a tab 55 to enable positioning of the housing 22 on the base 20.

The spring 24 is wound about a post 56 extending from the base 20. The post 56 may be angled off-center with respect to the axis of the base 20. The spring 24 biases the brush 26 through the tubular member 40. The electrical connector 50 is known in the art and includes a pigtail connector 51.

5 An end of the pigtail connector 51 is ultrasonically or resistively welded to the connection member.

The brush 26 includes a rectangularly cross-sectioned body portion 60 with first and second ends 62, 64, respectively. The first end 62 has an arcuate face 66 having a series of ribs 68 (see Figure 6). The ribs 68 are in 10 sliding contact with the commutator 14 when the brush assembly is assembled onto the motor 10. The second end 64 includes a spring retention plunge 70. The spring retention plunge 70 is a generally conical-shaped depression, with a sloping, arcuate face 72 forming a wall 74. A recess 76 is also provided and includes a surface where the pigtail 50 interconnects with 15 the brush 26.

The slope S (see Figure 4) of the arcuate face 72 of the spring retention plunge 70 is preferably greater than 0 and less than or equal to 15 degrees. It will be appreciated, however, that this range may deviate as design requirements dictate. The spring retention plunge 70 is formed to 20 retain a contact end 73 of the spring 24. The contact end 73 is prohibited from moving along a lateral axis A (see Figure 6) of the brush 26. Likewise, the contact end 73 has limited movement along a transverse axis B (see Figure 4) of the brush 26. More specifically, the wall 74 prohibits excessive travel of the contact end 73 along the transverse axis B, in that direction. The 25 slope of the spring retention plunge 70 enables the contact end 73 of the spring 24 to ride within the spring retention plunge 70 to provide constant contact with the brush 26. Ordinarily, the contact end 73 rides at the bottom of the arc. This constant contact provides the force which, due to the slope, is substantially constant during wear of the brush 26. The constant force 30 eliminates bouncing of the brush 26 and therefore increases the brush wear durability and prohibits damage to the commutator 14.

The spring retention plunge 70 of the brush 26 provides another advantage in that it is more easily manufactured than prior art forms. More particularly, to form the plunge 70, a single step process may be implemented, whereby a grinding wheel or round mill is plunged into the brush 26 at an angle relative to the top face of the brush 26. The grinding wheel diameter, tilt angle and cut depth can be varied to provide an optimum plunge 70. For optimization, the width and slope of the plunge 70 are considerations for the amount of play the spring 24 will have while still biasing the brush 26. In this manner, manufacture of the brush 26 is variable and simplified and savings are achievable in both cycle time and machine cost.

With particular reference to Figure 7, an exemplary power tool 80 is shown, such as a power drill. The power tool 80 includes a housing 82 having the motor 10 mounted therein, and an output member 84 in driven engagement with the motor 10. A power supply, such as a power cord or battery, is also included to respectively provide remote or local drive power to the motor 10.

The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded 20 as a departure from the spirit and scope of the invention.